

WHAT IS CLAIMED IS:

1. A high-temperature heat treatment method for carbon fiber which has been produced through thermal decomposition reaction of a carbon source and a transition metal catalyst, serving as main raw materials, which method comprises vaporizing an impurity contained in the carbon fiber, and discharging the impurity through a high-temperature section of a heat treatment furnace while being accompanied by a carrier gas.
2. The high-temperature heat treatment method for carbon fiber as claimed in claim 1, further comprising cooling the impurity accompanied by the carrier gas to solidify the impurity, and recovering the impurity.
3. The high-temperature heat treatment method for carbon fiber as claimed in claim 1 or 2, further comprising returning the carrier gas to the heat treatment furnace, after the impurity is recovered, and recycling the gas to be passed through the furnace.
4. The high-temperature heat treatment method for carbon fiber as claimed in claim 1 or 2, wherein the impurity is a transition metal.
5. The high-temperature heat treatment method for carbon fiber as claimed in claim 1 or 2, wherein an amount of Fe, Ni, or Co contained in the carbon fiber which has undergone heat treatment is about 100 mass ppm or less.
6. A high-temperature heat treatment apparatus for heat-treating carbon fiber which has been produced through thermal decomposition reaction of a carbon source and a transition metal catalyst, serving as main raw materials, which furnace comprises a hollow cylindrical heating furnace body of graphite or carbon having at least an open end or an end which can be opened or closed; a heat insulator provided around the hollow cylindrical furnace body; a feed inlet for feeding a carrier gas into the furnace provided in a vicinity of a feed end and/or discharge end, and a discharge outlet for discharging the carrier gas to the outside of the furnace provided in a vicinity of a highest-temperature section

10 of the furnace, wherein the carbon fiber is continuously fed, heated, and discharged through the furnace.

7. The high-temperature heat treatment apparatus as claimed in claim 6, wherein heat treatment is carried out at approximately 2,000-3,000°C.

8. The high-temperature heat treatment apparatus as claimed in claim 6 or 7, further comprising a recovery site for cooling an impurity contained in the carrier gas to solidify provided adjacent to the carrier gas discharge outlet of the furnace.

9. The high-temperature heat treatment apparatus as claimed in claim 8, wherein the furnace further comprises a means for returning the carrier gas to the carrier gas feed inlet after recovery of the impurity.

10. A method for producing the carbon fiber, comprising a step of carrying out a thermal decomposition reaction of a carbon source and a transition metal catalyst, serving as main raw materials, and a step of a heat treating the thermal decomposition, wherein said step of heat treating comprises  
5 the high-temperature heat treatment method for carbon fiber as claimed in claim 1 or 2.

11. A carbon fiber obtained by the high-temperature heat treatment method for carbon fiber as claimed in claim 1 or 2.

12. A carbon fiber obtained by the method for producing the carbon fiber as claimed in claim 10.

13. The carbon fiber as claimed in claim 11, comprising about 100 ppm or less of a metal element selected from the group consisting of Fe, Ni, Co, Cu, Mo, Ti, V and Pd.

14. The carbon fiber as claimed in claim 12, comprising about 100 ppm or less of a metal element selected from the group consisting of Fe, Ni, Co, Cu,

Mo, Ti, V and Pd.

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